# User Manual

# PX1 – GLONASS & GPS PCI Express® Mini Card

*Configuration example*

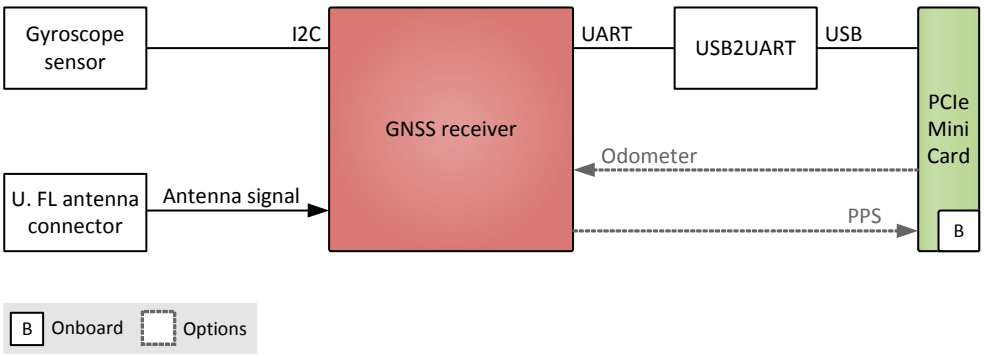
# PX1 - GLONASS & GPS PCI Express® Mini Card

The PX1 is a PCI Express® Mini Card providing a GNSS receiver with GLONASS and GPS functionality. It supports active or passive antennas, which can be connected to an U.FL connector. The received antenna signals are sent to the host via USB.

GLONASS is the Russian alternative to GPS and has comparable coverage and precision. The PX1 is prepared to support the European Union's global navigation satellite system Galileo and the Chinese navigation satellite system Compass.

The GNSS module provides a gyroscope sensor for dead reckoning functions, which enable accurate positioning. Various Satellite-Based Augmentation Systems (SBAS) are also supported. The PX1 provides communication information compliant to the NMEA 0183 protocol.

## Diagram



# Technical Data

### GNSS Interface

- 32-channel GNSS (Global Navigation Satellite System) receiver
- GPS Band/Code: L1 frequency, C/A code, SPS
- GLONASS Band/Code: L1 frequency, C/A code, SP
- Integrated TCXO, RTC
- Assisted GPS support
- Dead Reckoning support (gyroscope)
- Differential GPS support
  - Satellite Based Augmentation System (WAAS, Egnos, MSAS)
  - RTCM104
- Accuracy (unaided):
  - Position: 3 m horizontal, 5 m vertical
  - Velocity: 0.05 m/s
  - Time: 1 µs
- Time To First Fix (TTFF):
  - Cold start: 35 s typ.
  - Hot start: 2 s typ.
- Sensitivity:
  - Acquisition (cold): -147 dBm
  - Re-Acquisition: -157 dBm
  - Tracking: -161 dBm
- Acceleration: 5 g max.
- Velocity: 515 m/s max.
- Altitude: 18 000 m max.
- Protocol: NMEA 0183 rev. 3.01
- One U.FL antenna connector
  - For the use of an external active or passive antenna
  - Phantom power supply: 3.3V

### Host Interface

- PCI Express® Mini Card connector
  - USB 2.0

### Electrical Specifications

- Supply voltage/power consumption:
  - +3.3 V, max. 191 mA
  - Impedance: 50 Ohm

### Mechanical Specifications

- Dimensions: 30 mm x 58 mm x 5 mm (PCI Express® Full-Mini Card)
- Weight: 4 g

### Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (qualified)
  - Airflow: min. 1 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3000 m
- Shock: 15 g, 11 ms
- Bump: 10 g, 16 ms
- Vibration (sinusoidal): 1 g, 10..150 Hz
- Conformal coating on request

### MTBF

- tbd h @ 40°C according to IEC/TR 62380 (RDF 2000)

### Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

### EMC Conformity

- EN 50121-3-2 (table 4) (EMC in rolling stock)
- EN 55011 (radio disturbance)
- EN 61000-4-2/EN 50121-3-2 (table 9) (ESD)
- EN 61000-4-3/EN 50121-3-2 (table 9) (electromagnetic field immunity)
- EN 61000-4-4/EN 50121-3-2 (table 8) (burst)
- EN 61000-4-6/EN 50121-3-2 (table 7) (immunity to conducted disturbances)

### Software Support

- For information on first installation please contact MEN.

Also see Configuration Options.

# Configuration Options

### *Functionality*

- Odometer input/PPS output
- Without Dead Reckoning support (gyroscope not assembled)
- Phantom power supply: 3.3V

### *Mechanical*

- Conformal coating

**Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.**

For available standard configurations see the online data sheet.

# Product Safety

## Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Only store the board in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

# About this Document

This user manual is intended only for system developers and integrators, it is not intended for end users.

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

### History

| Issue | Comments | Date |
|---|---|---|
| E1 | First issue | 2013-05-06 |
| E2 | Added: Phantom power supply: 3.3V | 2014-06-13 |

## Conventions

Indicates important information or warnings concerning the use of voltages that could lead to a hazardous situation which could result in personal injury, or damage or destruction of the component.

Indicates important information or warnings concerning proper functionality of the product described in this document.

The globe icon indicates a hyperlink that links directly to the Internet, where the latest updated information is available.

When no globe icon is present, the hyperlink links to specific elements and information within this document.

| | |
|---|---|
| *italics* | Folder, file and function names are printed in *italics*. |
| **bold** | **Bold** type is used for emphasis. |
| `mono` | A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by `"0x"`. |
| comment | Comments embedded into coding examples are shown in green text. |
| IRQ#<br>/IRQ | Signal names followed by a hashtag "#" or preceded by a forward slash "/" indicate that this signal is either active low or that it becomes active at a falling edge. |
| in/out | Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "from it the board or component". |
| | Blue vertical lines in the outer margin indicate sections where changes have been made to this version of the document. |

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Since January 2005 the SMD and manual soldering processes at MEN have already been completely lead-free. Between June 2004 and June 30, 2006 MEN's selected component suppliers have changed delivery to RoHS-compliant parts. During this period any change and status was traceable through the MEN ERP system and the boards gradually became RoHS-compliant.

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# 1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

## 1.1 Map of the Board

***Figure 1.*** *Map of the board – top view*

## 1.2 Integrating the Board into a System

You can use the following check list when installing the card in a system for the first time and with minimum configuration. The installation of the PX1 depends on the carrier board. Please refer to your carrier board's user manual before installing the PX1.

- ☑ Power down the system and remove the PCI Express Mini Card carrier board.
- ☑ Install the PX1 on the PCI Express Mini Card slot of the carrier board as described in the carrier board's user manual.
- ☑ Insert the carrier board into the system again
- ☑ Power up the system.

# 2 Connecting the PCI Express Mini Card

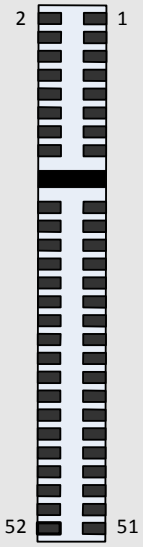
## 2.1 Peripheral Interface

An external active or passive antenna can be connected to the U.FL antenna connector. Depending on the used antenna, an U.FL to SMA adapter might be required to connect an antenna.

## 2.2 Host Interface

The PX1 connects to the carrier board via a PCI Express Mini Card connector.
PCI Express® Mini Cards use either a single PCI Express lane (x1) or a USB connection; the PX1 only supports the USB 2.0 connection. It is equipped with one 52-pin standard PCI Express Mini Card connector. The following standard signals are supported (signal directions according to PCI Express Mini Card standard):

***Table 1.*** *Pin assignment of PCI Express Mini Card connector*




| | | | |
|---|---|---|---|
| 2 | +3.3Vaux | 1 | WAKE# |
| 4 | GND | 3 | reserved |
| 6 | 1.5V | 5 | reserved |
| 8 | UIM_PWR | 7 | CLKREQ# |
| 10 | UIM_DATA | 9 | GND |
| 12 | UIM_CLK | 11 | REFCLK- |
| 14 | UIM_RST | 13 | REFCLK+ |
| 16 | UIM_VPP | 15 | GND |
| | | | |
| 18 | GND | 17 | reserved |
| 20 | W_DISABLE# | 19 | reserved |
| 22 | PERST# | 21 | GND |
| 24 | +3.3Vaux | 23 | PERn0 |
| 26 | GND | 25 | PERp0 |
| 28 | +1.5V | 27 | GND |
| 30 | SMB_CLK | 29 | GND |
| 32 | SMB_DATA | 31 | PETn0 |
| 34 | GND | 33 | PETp0 |
| 36 | USB_D- | 35 | GND |
| 38 | USB_D+ | 37 | GND |
| 40 | GND | 39 | +3.3Vaux |
| 42 | LED_WWAN# | 41 | +3.3Vaux |
| 44 | LED_WLAN# | 43 | GND |
| 46 | LED_WPAN# | 45 | reserved |
| 48 | +1.5V | 47 | reserved/ODO |
| 50 | GND | 49 | reserved/1PPS |
| 52 | +3.3Vaux | 51 | reserved |

***Table 2.*** *Signal mnemonics of 52-pin PCI Express Mini Card connector*

| | Signal | Direction | Function |
|---|---|---|---|
| **Power** | GND | - | Ground |
| | +3.3Vaux | out | 3.3V source |
| | 1.5V | out | 1.5V source |
| **SIM card**[1] | UIM_PWR | in | SIM card power |
| | UIM_DATA | in/out | SIM card data |
| | UIM_CLK | in | SIM card clock |
| | UIM_RST | in | SIM card reset |
| | UIM_VPP | in | not connected |
| **PCI Express**[1] | REFCLK-<br>REFCLK+ | out | PCI Express differential reference clock |
| | PERn0/PERp0 | in | PCI Express receive signals |
| | PETn0/PETp0 | out | PCI Express transmit signals |
| **Auxiliary Signals**[1] | CLKREQ# | in | Clock request |
| | PERST# | out | Reset for the Mini Card |
| | W_DISABLE# | out | Wireless disable |
| | WAKE# | in | Wake signal |
| | SMB_CLK | out | System management bus clock |
| | SMB_DATA | in/out | System management bus data |
| **USB** | USB_D- | in/out | USB line |
| | USB_D+ | in/out | USB line |
| **Communications - specific signals**[1] | LED_WWAN# | in | not connected |
| | LED_WLAN# | in | not connected |
| | LED_WPAN# | in | not connected |
| **Optional** [2] | ODO | in | Odometer input |
| | 1PPS | out | PPS output |

[1] Signals in grey font are not supported.
[2] These signals are only available as an option.

Please refer to the PCI Express Mini Card Specifications in Chapter 4.1.1 PCI Express Mini Card on page 16, for further details

# 3 Functional Description

## 3.1 Power Supply

The PX1 is supplied with 3.3V via the PCI Express Mini Card connector.

### 3.1.1 Power Supply for Active Antennas

The standard power supply for the PX1 is 3.3 V. A phantom supply is available as an option, allowing the PX1 to supply active GPS antennas with 3.3 V or 5 V. In addition, it is possible to extend the power supply to 3.5 V or 5 V with either an optional assembly, or a version that has been configured specifically.

## 3.2 GNSS Interface

The PX1 is equipped with a 32-channel Fastrax IT600 GNSS receiver, which supports GPS and GLONASS funtionality. The GNSS signals are received via an onboard U.FL connector, which has to be connected to an external antenna.

**The PX1 itself has no antenna. Please note that MEN does not supply antennas with the PX1, since the choice of a suitable antenna depends on your application.**

Please see Technical Data for detailed information on the GNSS interface.

## 3.3 Software Requirements

The PX1 does not require a specific driver. The USB2UART interface is supported under Linux, kernels higher than 3.0 and under Windows 7 and newer.

Please check the MEN website for a VxWorks driver.

For evaluation software, please see the u-blox website (GNSS receiver manufacturer).

For integration software please go to FreeGPS.

For more information on first installation please contact the MEN sales team.

# 4 Appendix

## 4.1 Literature and Web Resources

PX1 data sheet with up-to-date information and documentation:
www.men.de/products/15PX01-.html

### 4.1.1 PCI Express Mini Card

PCI Express Mini Card Electromechanical Specification Rev. 2.0
August 31, 2011
PCI Special Interest Group
www.pcisig.com

### 4.1.2 GNSS

- Fastrax IT600 GNSS Receiver
  www.u-blox.com/images/downloads/Product_Docs/IT600_Datasheet.pdf
- GNSS in general
  en.wikipedia.org/wiki/Satellite_navigation

## 4.2 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the PX1. You can find information on the article number, the design revision and the serial number on a label attached to the board.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

***Figure 2.*** *Labels showing the product's article number, revision and serial number*